Video-assisted thoracoscopic treatment of benign mediastinal masses: analysis of 44 cases

Video-assisted thoracoscopic surgery

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Abstract

Aim: Compared with the conventional surgical procedures, video-assisted thoracoscopic surgery (VATS) is an alternative method for the management of thoracic pathologies. Along with recent advances, this method has become a standard approach to benign mediastinal lesions. In this study, it's aimed to emphasize the usefulness of VATS for the treatment of benign mediastinal masses. Material and Method: In this study, 44 cases that were diagnosed with benign mediastinal mass operated by VATS in a single thoracic surgery department between January 2009 and January 2015 were evaluated retrospectively and compared to literature data. The cases were analyzed according to age, sex, symptoms, signs, diagnostic procedures, pathological findings and postoperative complications in the early period. Results: Forty-four benign mediastinal lesions approached with VATS were included in the study. The average age of the cases was 49, and 28 of them were female while 16 were male, 27.3 % of cases were asymptomatic. The most frequent symptoms were: shortness of breath, chest pain, and cough. In all cases, complete resection was performed by using VATS technique. Postoperative complication rate was 9.1% and 4.5% of those was prolonged air leak. During the follow-up period recurrence has been developed in only 2 cases. Discussion: The localization and pathologic diagnosis of the lesions are determinant for the treatment of benign mediastinal masses. Surgical approach with VATS plays an important role in diagnosis and treatment of mediastinal lesions. VATS should be preferred priority in surgical treatment of mediastinal masses and cysts, due to postoperative advantages.

Keywords

Video-Assisted Thoracoscopic Surgery; Benign Mediastinal Mass; Mediastinal Cysts

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Introduction

In mediastinal masses, video-assisted thoracoscopic surgery (VATS) is used for diagnosis, staging, and treatment [1, 2]. VATS was initially used in the removal of tumors of limited size (< 5 cm), especially neurogenic tumors, bronchogenic cysts, and some pleura-based masses [3]. More recently, VATS in mediastinal masses and cysts has been widely used for diagnostic or therapeutic purposes in selected cases [4]. This practice is increasingly being used in the diagnosis and treatment of benign mediastinal masses, because of the advantages of VATS tools and techniques and as it is less invasive and has fewer side effects compared to open surgery, and provides a shorter healing period, earlier return to work, and lower costs [5].

In our study, 44 benign mediastinal mass cases, treated by VATS in the single thoracic surgery center, were retrospectively evaluated. The cases were evaluated in terms of age, sex, complaints, clinical findings, localization, size, diagnostic evaluations, pathologies, hospital stay, and complications, and were compared to the information in the literature.

Material and Method

Forty-six of the 178 cases of benign mediastinal masses were treated using the VATS method in our clinic, between January 2009 and January 2015. The researchers were able to obtain information regarding 44 of 46 patients with VATS, who were reported to have pathologically benign mediastinal masses, and these cases were evaluated retrospectively. The cases were evaluated in terms of age, gender, complaints, clinical findings, lesion localization, preoperative radiological evaluation, computed tomography (CT) and pathologic dimension, histopathological diagnosis, hospital stay and early postoperative period (first seven days) complications; and were compared with the literature.

The study includes the cases that underwent total excision by VATS due to mediastinal mass, and with a benign histopathology. The average follow-up period of the cases was 7.2 months (2-26 months). Patients who were started with VATS approach and converted to open surgery (because of intraoperative complications or surrounding tissue invasion) were not included in the study. Pathologies regarding heart, large vessel, lung, diaphragm, skeletal structures, and metastatic tumors were excluded from the study.

Results

Forty-four benign mediastinal masses treated by VATS in our clinic were included in the study. Twenty-eight of our cases were female, 16 were male, and the mean age was 49 (19-75). Left-sided VATS was applied to 9 (20.5%) cases, whereas right-sided VATS was applied to 35 (79.5%). Thirty-four (77.3%) of the benign mediastinal masses treated with VATS were cystic and 10 (22.7%) were massive. The rate of asymptomatic cases was 27.3%, 22.7% of the cases had shortness of breath, 20.5% had chest pain, 11.4% had coughing, 4.5% had hemoptysis, 4.5% had myasthenia gravis , 4.5% of patients had indole weakness, 2.3% had back pain, and 2.3% had dysphagia (Table 1).

There were two patients who presented with hemoptysis complaint: a 69-year-old female patient with a 5 cm bronchogenic cyst located in the visceral mediastinum and a 75-year-old male with a 6 cm parathyroid cyst located in the visceral mediastinum. The hemoptysis was suspected to have hemorrhagic origin due to cystic degeneration.

Table 1. Distribution of symptoms in benign mediastinal masses

SYMPTOMS	%
Asymptomatic	%27,3
Dyspnea	%22,7
Chest Pain	%20,5
Cough	%11,4
Hemoptysis	%4,5
Myastenia Gravis	%4,5
Weakness	%4,5
Back pain	%2,3
Dysphagia	%2,3

Myasthenia gravis (MG) was determined to affect only two cases of all patients with thymic pathology. A 33-year-old male with a 5 cm mass lesion located at the anterior mediastinum and a 33-year-old woman with a 2.5 cm mass lesion located at the anterior mediastinum were histopathologically diagnosed with thymic hyperplasia. During the follow-up period, MG findings were observed to have decreased in both cases.

All of our cases were evaluated by PA chest x-ray and all cases were evaluated by thorax CT. The additionally requested diagnostic examinations were as follows: three mediastinal cysts and three thymic lesions, thorax magnetic resonance imaging (MRI); two mediastinal cysts, echocardiography; one mediastinal cyst, MRI angiography; one mediastinal cyst, CT angiography; two parathyroid cysts, thyroid USG and parathyroid scintigraphy; and 1 mediastinal cyst, PET- CT. Invasive procedures for diagnostic purposes were not performed except for the imaging methods. VATS was applied for the treatment of lesions with cystic maturity in the imaging examinations and for the diagnosis and treatment of the lesions with solid maturity.

Mediastinal cysts (38.6%) and thymic lesions (38.6%) were the most common pathological diagnoses. Bronchogenic cysts were the most common mediastinal cysts, and thymic hyperplasia was the most common among thymic lesions (Tables 3 and 4). In our study, lesions were most commonly detected on the anterior mediastinum (50.0%). In the anterior mediastinum, the

Table 2. Distribution of cases according to mediastinal regions

DİAGNOSİS	ANTERIOR	VISSERAL	POSTERIOR	TOTAL
Mediastinal Cysts	2	11	4	17 (%38,6)
Thymic Lesions	16	1		17 (%38,6)
Neurogenic Tumors	1		1	2 (%4,5)
Benign germ cell tumors	2			2 (%4,5)
Mesench-ymal Lesions			2	2 (%4,5)
Castleman's Disease	1	1		2 (%4,5)
Parathyroid Lesions		2		2 (%4,5)
TOTAL	22 (%50)	15 (%34,1)	7 (%15,9)	44

Table 3. Distribution of mediastinal cysts according to frequency

MEDİASTİNAL CYSTS	ANTERIOR	VISSERAL	POSTERIOR	TOTAL
Bronchogenic Cysts	1(%5,8)	4(%23,5)	2(%11,7)	7 (%41,1)
Pericardial Cysts	1(%5,8)	5(%29,4)	-	6 (%35,2)
Paraesophageal Cysts	1(%5,8)	1(%5,8)	1(%5,8)	3 (%17,6)
Parathyroid Cysts	-	1(%5,8)	-	1(%5,8)
TOTAL	3(%17,6)	11(%64,7)	3(%17,6)	17(%100)

Table 4. Distribution of thymic lesions according to frequency

THYMİC LESİONS	ANTERİOR	VİSSERAL	POSTERİOR	TOTAL
Thymic Hyperplasia	10 (58,8)		-	10 (%58,8)
Thymoma	4 (%23,5)	1 (%5,8)	-	5 (%29,4)
Thymolipoma	1 (%5,8)		-	1 (%5,8)
Regressed Thymus Tissue	1 (%5,8)		-	1 (%5,8)
TOTAL	16 (%94,1)	1 (%5,8)	-	17 (%100)

majority (72.7%) were thymic lesions. Mediastinal cysts (73.3%) were seen frequently in the visceral compartment (Table 2).

Bronchogenic cysts (41.1%), which are foregut cysts, were the most common among the mediastinal cysts (Figure 1). Among seventeen cystic lesions, bronchogenic cysts are followed by pericardial cysts (35.2%), paraesophageal cysts (17.6%) and parathyroid cysts (5.8%). The distribution of mediastinal cysts by region is presented in Table 3.

Sixteen (94.1%) of 17 thymic lesions completely resected with VATS, had anterior mediastinal localization. Only one case of thymoma was localized in the visceral compartment. Ten patients had thymic hyperplasia (58.8%). They made up 22.7% of all mediastinal benign masses. Five of the thymic lesions were thymoma (29.4%) and they made up 11.3% of all benign mediastinal masses (Figure 2). There was thymolipoma in one case, and atrophic thyroid tissue was detected in another case (Table 4). The average size of the lesions was 3.56 cm (1.5-6.0 cm).

One of the two neurogenic tumors was detected in the posterior compartment and the other was detected in the anterior mediastinum. Both of our cases were diagnosed as schwannoma (Figure 3). The incidence among all benign mediastinal cysts was calculated as 4.5% (Table 2).

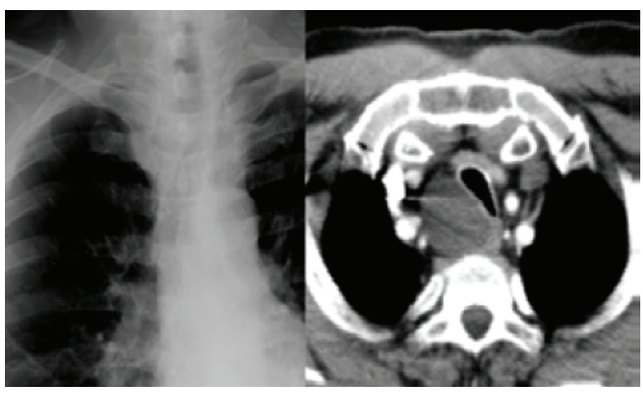

Figure 1. Posteroanterior chest X-ray and computed tomography (CT) image of bronchogenic cyst

Mesenchymal tumors constituted 4.5% of the patients in our study group. In both cases, the diagnosis was reported as a solitary fibrous tumor. The lesions were located in the posterior compartment.

Among the other benign mediastinal pathologies included in our study, two cases of Castleman's disease with visceral and anterior mediastinal localization, two cases of parathyroid adenomas localized to visceral mediastinum, and two mature cystic teratoma cases localized in the anterior mediastinum were also successfully excised by VATS.

The average hospital stay was 5.5 days (2-14 days). In our study, 40 patients (90.9%) had no complications, two patients (4.5%) had prolonged air leak, one case (2.3%) had hemorrhage and one case (2.3%) had atelectasis.

Aspiration was performed with posterior drainage and fiberoptic bronchoscopy due to the development of postoperative atelectasis in the 69-year-old male patient with Castleman's disease. A 46-year-old woman with thymic hyperplasia developed hemorrhagic drainage on the first postoperative day, which could be controlled with one unit of fresh frozen plasma, and was controlled without the need for revision. A 57-year-old female patient with thymic hyperplasia and a 69-year-old female patient with mediastinal cyst developed postoperative prolonged air leak.

In the follow-up period, recurrence was seen in two cases. A 68-year-old woman was diagnosed postoperatively with pericardial cyst 2 years later and a 50-year-old male patient was diagnosed postoperatively with type B1 thymoma recurrence 1 year later.

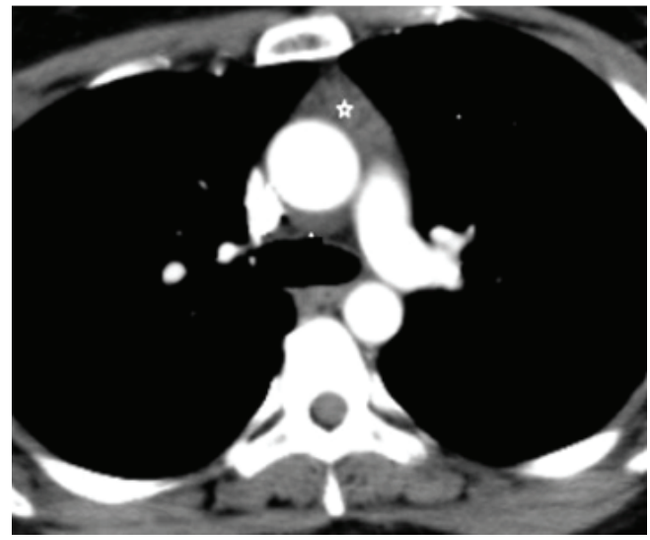

Figure 2. Computed tomography (CT) image of timoma

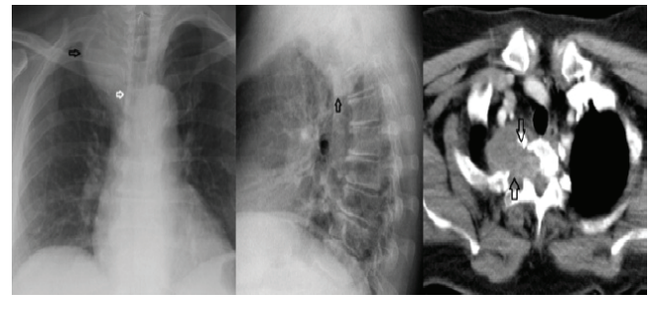

Figure 3. Posteroanterior chest X-ray, lateral X-ray and computed tomography (CT) image of schwannoma

Discussion

Primary tumors and cysts of the mediastinum are most commonly localized in the anterior mediastinum. This is followed by posterior mediastinal and visceral mediastinum [1, 2]. In our study, we found pathology in the anterior mediastinum to be the most common, with the rate of 50.0%; 34.1% of the cases were visceral, 15.9% were posterior mediastinal.

According to Donahue, thymomas are the most common mediastinal tumor in adults [6]. Mullen and Richardson have reported that in adults, 47% of anterior mediastinal tumors were composed of thymic lesions [7]. The most common mediastinal lesions according to localizations are thymomas in the anterior, enteric cysts in the visceral, and schwannomas in the posterior [6]. In our study, thymic hyperplasia (22.7%) was the most common among all benign mediastinal pathologies. In compliance with the literature, thymic lesions (72.7%) were the most common in the anterior mediastinum. The mediastinal cysts (73.3%) were found to be more common in the visceral compartment.

Signs and symptoms in mediastinal masses depend on the localization, the size, whether the lesion is benign/malignant, whether it is infected, and whether specific endocrine or biochemical products are released. Symptoms that can be seen due to the compression, invasion, and infection in mediastinal masses are as follows: coughing, stridor, dyspnea, dysphagia, voice anomaly, chest pain, vena cava superior syndrome, pleural effusion, pericardial effusion, Horner's syndrome, upper extremity pain, paraplegia, diaphragmatic palsy [1-6]. In our study, 27.3% of the cases were asymptomatic, 22.7% had dyspnea, 21.7% had chest pain, 11.4% had coughing, 4.5% had weakness, 4.5% had hemoptysis Myasthenia gravis in 4.5%, weakness in 2.3%, dysphagia in 2.3% and back pain in 2.3%.

Chest X-ray, thorax computerized tomography, magnetic resonance imaging, positron emission tomography, and thyroid scintigraphy can be used for non-invasive diagnosis of mediastinal lesions [8]. We also used a PA chest X-ray for the initial evaluation of all our cases, and all cases were evaluated with thorax CT. Six patients were preoperatively diagnosed additionally using thoracic MRI, 2 patients were diagnosed by echocardiography, 1 patient by MRI-angiography, 1 patient by CT-angiography, and 1 patient by PET-CT.

Mediastinoscopy, anterior mediastinotomy, mediansternotomy, VATS, thoracotomy, thoracotomy combined with sternotomy are the surgical methods for the diagnosis and treatment of mediastinal masses [9,10].

VATS is an important surgical method of the diagnosis and surgical treatment of mediastinal masses. The size, histologic features and residential area of the mass are very important in the planning of surgery. Even very large masses (> 10 cm) can be resected by VATS procedure [8]. The patient's operating position, and the use of 30-degree lens and ultrasonic or bipolar cutters makes these operations possible. VATS technique is primarily recommended in the treatment of mediastinal cysts. In addition, the vast majority of neurogenic tumors, thymic lesions, and benign germ cell tumors can also be resected by VATS [3, 4].

The VATS method has started to be more preferred than the open surgical approaches for mediastinal masses because of the significantly better postoperative comforts of the patients, shorter hospitalization times, shorter time to return to normal life, less postoperative pain, and fewer postoperative complications [3, 5].

Tumors originating from anterior mediastinal thymus are the main group in the VATS approach. It has been suggested in particular that stage 1 and 2 thymomas can be resected by VATS in thymomas [11]. During VATS thymectomy, the thymoma, thymus and all mediastinal fatty tissue should be removed. Complete dissection of the innominate vein and exploration of the bilateral phrenic nerves should be achieved [11-12].

In addition to being an effective and safe method of transsternal thymectomy, the use of video-assisted thoracoscopy allows to have less surgical trauma, less postoperative pain, preservation of pulmonary functional capacity in the postoperative period, shortened hospital stay and cosmetic advantages. Thus, VATS is currently increasingly preferred. As a result of the studies, it has been suggested that VATS should be applied in thymomas smaller than 3 cm and after at least 60 thymectomies [11, 13]. In our study, the average pathological dimension of the lesions treated with VATS thymectomy was 4.3 cm.

It is reported that 95% of thymomas are located in the anterior mediastinum [14, 15]. In our series, four of five cases (80%) of the thymoma were anterior mediastinal. It has been reported to be seen mostly in the 5th and 6th decades [14]. In our study, the mean age was 52.8, in compliance with the literature. As an exception, one case was detected at 39 years of age and the diagnosis was mixed type thymoma. Myasthenia gravis (MG) association can be seen in 30-73% of thymoma cases [12-15]. In our study, MG was not observed in patients with thymoma, but MG was present in two thymic hyperplasia cases.

Rare case reports include thymolipomas that are resected by VATS. In our study, one case of thymolipoma, that was 4 cm in size, was successfully excised by VATS.

In our study, mediastinal cysts (38.6%) were the most common along with thymic lesions (38.6%). VATS should be preferred against thoracotomy in cases with mediastinal cystic lesions, because of its current advantages, as long as the cyst can be completely excised by VATS [16]. In our study, bronchial cysts (41.1%) were the most common mediastinal cysts that could be excised by VATS, and pericardial cysts (35.2%) were the second most common. Even if asymptomatic bronchogenic cysts are present, surgical excision is recommended because of the precise tissue diagnosis, prevention of perforation and risk of malignant transformation [17, 18]. However, in symptomatic cases, surgery is the only option and total excision of the cystic lesion is necessary. If total excision cannot be performed, recurrence may develop [18]. In our study, one case of pericardial cyst recurred 2 years after surgery.

Neurogenic tumors are tumors which mostly consist of schwannomas or ganglioma, which are rarely malignant, with posterior mediastinal paravertebral sulcus placement [19, 20]. Treatment consists of surgical resection. Surgery removes symptoms associated with local growth, confirms the diagnosis, and excludes malignancy. In addition, long-term malignant degeneration is also prevented [4, 19]. Hazelrigg et al. found that among 23 patients that underwent VATS due to neurogenic tumors had a mean hospitalization time of 2 days (1-9) [21]. Transcervical, thoracotomy, and VATS approaches were compared in another

series of twenty-three cases, and the duration of hospital stay and blood loss were significantly lower in the VATS-treated patients compared to the other groups [22]. In our study, two neurogenic tumors were successfully excised by VATS. Postoperative hospitalization time was 5 and 7 days, and no complications occurred in the two patients.

Germ cell tumors constitute 10-20% of mediastinal masses. Although they are frequently anterior mediastinal, 3-8% of them can be placed in the posterior mediastinum. Patients who cannot be diagnosed by non-surgical methods require excision for definitive diagnosis and treatment purposes [23]. In our study, both germ cell tumor cases we excised with VATS were located in the anterior mediastinum.

Mesenchymal tumors constitute less than 6% of mediastinal lesions [24]. In our study, benign mesenchymal tumors located in the posterior compartment constituted 4.5% of all benign mediastinal lesions.

In our study, we found two rare cases of Castleman's Disease that we excised by VATS. Castleman's disease, a benign lymph node hyperplasia, is usually asymptomatic and most patients are diagnosed under the age of 30 [25]. The average age of the cases in our study was 65 years.

VATS can also be used in the surgery of endocrine system-derived tumors. Twenty percent (20%) of the parathyroid glands with primary or secondary hyperparathyroidism are ectopic and 1-2% are localized in the mediastinum. Adenomas localized in the anterior mediastinum, or in the paratracheal area, especially those that are localized ectopically in the mediastinum, can be resected by VATS [25]. In our study, two parathyroid adenomas were successfully excised with VATS, and patients were discharged on the 3rd and 7th day without postoperative complications.

In the invasive diagnosis and treatment of mediastinal masses, localization and pathological diagnosis of the lesion are determining factors. Surgical approach with VATS is important in the diagnosis and treatment of mediastinal lesions except for limited cases.

In cases that are appropriate for VATS in the surgical treatment of mediastinal masses and cysts, VATS should be preferred to open surgical methods due to reduced hospitalization time, return to normal life or work, shorter postoperative pain, fewer postoperative complications.

VATS should be considered primarily in the treatment of mediastinal cysts. In addition, VATS should be the first choice for the treatment of neurogenic tumors, thymic lesions, benign germ cell tumors, and parathyroid adenomas.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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References

1. Shields TW. The mediastinum, its compartments, and the mediyastinal lymph nodes. In: Shields TW, Lo Cicero 111 J, Reed CE, Feins RH eds. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams &Wilkins; 2009. p.2055-58.
2. Kirschner PA. Anatomy and surgical Access of the medistinum. In: Pearson FG, Cooper JD, Deslauriers J, Ginsberg RJ, Hiebert CA, Patterson GA, Urschel HC, eds. Thoracic Surgery. 7th ed. Philadelphia: Churchill Livingstone; 2002. p.1563-68.
3. Demmy TL, Krasna MJ, Detterbeck FC, Kline GG, Kohman LJ, DeCamp MM et al. Multicenter VATS experience with mediastinal tumor. Ann Thorac Surg. 1998; 66: 187-92.
4. Gossot D, Izquierdo RR, Girard P, Stern JB, Magdeleinat P. Thoracoscope resection of bulky intrathoracic benign lesions. Eur J Cardiothorac Surg. 2007; 32: 848-51.
5. Toker A, Tanju S, Ziyade S, Kaya S, Dilege S. Learning curve in videothoracoscopic thymectomy: how many operations and in which situations? Eur J Cardiothorac Surg. 2008; 34: 155-8.
6. Donahue JM, Nichols FC. Primary mediyastinal tumors and cysts and diagnostic investigation of mediyastinal masses In: Shields.TW, Lo Cicero III J, Reed CE, Feins RH eds. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams &Wilkins; 2009. p.2195-99.
7. Mullen B, Richardson JD. Primary anterior mediyastinal tumors in children and adults. Ann Thorac Surg. 1986; 42(3): 338-45.
8. MillerWT, Shah RM. Radiographic, computed Tomographic, and magnetic resonance investigation of the mediastinum. In: Shields TW, Lo Cicero III J, Reed CE, Feins RH eds. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2009. p.2079-101.
9. Lazzaro RS, LoCicero III J. Transcervical Mediyastinal Lymph Node Sampling and Lymphadenectomy. In: Shields TW, Lo Cicero III J, Reed CE, Feins RH eds. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams &Wilkins; 2009. p.2145-51.
10. Marshall MB. Thoracic Incisions. In Kaiser LR, Kron IL, Spray TL.Mastery of Cardiothoracic Surgery, 2nd ed. Philadelphia: Lippincott Williams &Wilkins; 2007. p.26-32.
11. Toker A, Tanju S, Sungur Z, Parman Y, Sentürk M, Serdaroglu P, et al. Videothoracoscopic thymectomy for nonthymomatous myasthenia gravis: results of 90 patients. Surg Endosc. 2008; 22: 912-6.
12. Grip S, Hügers K, Wurm R, Schmitt G. Thymoma; Prognostic Factors and Treatment Outcomes. Cancer. 1998; 83: 1495-503.
13. Mack MJ, Landreneau RJ, Yim AP, Hazelrigg SR, Scruggs GR. Results of video-assisted thymectomy in patients with myasthenia gravis. J Thorac Cardiovasc Surg. 1996; 112: 1352-9.
14. Lewis JF, Wick MR, Scheithauer BW, Bernatz PE, Taylor WF. Thymoma: a clinicopathologic review. Cancer. 1987; 60: 2727-43.
15. Monden Y, Nakahara K, Lioka S, Nanjo S, Ohno K, Fujii Y, et al. Recurrence of thymoma: clinicopathological features, therapy, and prognosis. Ann Thorac Surg. 1985; 39: 165-9.
16. Yoshino I, Hashizume M, Shimada M, Tomikawa M, Sugimachi K. Video-assisted thoracoscopic extirpation of a posterior mediyastinal mass using the da Vinci computer enhanced surgical system. Ann Thorac Surg. 2002; 74: 1235-37.
17. Cuypers P, De Leyn P, Cappelle L, Verougstraete L, Demedts M, Deneffe G. Bronchogenic cysts: a review of 20 cases. Eur J Cardio-thorac Surg. 1996; 10: 393-6.
18. Weber T, Roth TC, Beshay M, Herrmann P, Stein R, Schmid RA. Video assisted thoracoscopic surgery of mediyastinal bronchogenic cysts in adults: A single center experience. Ann Thorac Surg. 2004 ;78: 987-91.
19. Reynolds M, Shields TW. Benign and Malignant Neurogenic Tumors of the Mediastinum in Children and Adults. In: Shields TW, Lo Cicero III J, Reed CE, Feins RH eds. General Thoracic Surgery. 7th ed. Philadelphia: Lippincott Williams &Wilkins; 2009. p.2415-40.
20. Bousamra M. Neurogenic tumors of the mediastinum. In: Pearson FG, Cooper JD, Deslauriers J, Ginsberg RJ, Hiebert CA, Patterson GA, Urschel HC, eds. Thoracic Surgery. 2nd ed. Philadelphia: Churchill Livingstone; 2002. p.1732-8.
21. Hazelrigg SR, Boley TM, Krasna MJ, Landreneau RJ, Yim AP. Thoracoscopic resection of posterior neurogenic tumors. Am Surg. 1999; 65: 1129-33.
22. Pons F, Lang-Lazdunski L, Bonnet PM, Meyrat L, Jancovici R. Videothoracoscopic resection of neurogenic tumors of the superior sulcus using the harmonic scalpel. Ann Thorac Surg. 2003; 75: 602-4.

23. Cheung Y, Ng Sh, Wan Y. Ruptured mediyastinal cystic teratoma with intrapulmonary bronchial invasion: CT demonstration. The British Journal of Radiology. 2001; 74: 1148-9.
24. Fang HK, Sundaresan S. Unusual mediyastinal tumors. In: Pearson FG, Cooper JD, Deslauriers J, Ginsberg RJ, Hiebert CA, Patterson GA, Urschel HC, eds. Thoracic Surgery. 2nd ed. Philadelphia: Churchill Livingstone. 2002. p.1739-48.
25. Olak J. Benign lymph node disease involving the mediastinum. In: Shields TW, Lo Cicero III J, Ponn RB, Rusch VW,eds. General Thoracic Surgery. 6th ed. Philadelphia: Lippincott Williams&Wilkins; 2005. p.2676-81.

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